L Number	Hits	Search Text	DB	Time stamp
1	3	amplitude adj modulation with texture	USPAT	2002/11/20 14:15
2	1	amplitude adj modulation with texture	US-PGPUB	2002/11/20 14:17
3	20	modulation with texture	US-PGPUB	2002/11/20 14:17
4	132	modulation with texture	USPAT	2002/11/20 14:24
5	1	("4727365").PN.	USPAT	2002/11/20 14:25

US-PAT-NO: 4905164

DOCUMENT-IDENTIFIER: US 4905164 A

TITLE: Method for modulating color for effecting color cell texture

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col. 1 line 55

Cell Texture image modulation described in the Bunker et al application uses monochrome modulation of an existing data base face color that is combined with face translucency information. That is, the cell texture processing for each cell is controlled by the intensity of a composite color assigned to and corresponding translucency of a face. True full color cell texture modulation could be produced by sequentially processing three faces, each face being assigned one of the triad of primary colors (i.e. red, green, blue; hereinafter "RGB"), with appropriate intensity and translucency obtained from the texture map for each cell. However, this approach would be very inefficient. Such processing would consume a large portion of available real time image processing capability. Furthermore, a straightforward modification to add true full color cell modulation to the configuration of Bunker et al would require a substantial increase in cell texture hardware.

amplitude

While some previous systems have permitted simultaneous but equal modulation of all RGB components of a pixel (i.e., monochrome modulation), it was not practical prior to the present invention to have individualized independent true full color modulation of each of the respective RGB components for cell texturing in a real time image generation system. True

full color modulation
as used herein may be described as the ability to control the RGB components by
independently modulating the RGB components using a single texture code so that
a realistic color image may be displayed on a single face.

It is therefore an object of the present invention to provide real-time
computer image generation with true full color cell texture modulation.

It is another object of the invention to provide a real time video image
generator with true full color cell texture modulation while minimizing
hardware requirements.

FIG. 2 is a block diagram of a cell texture generator in accordance with the
present invention. Although only a portion of the cell texture generator
circuitry (i.e. red color components 200) for processing data along pixel
computation paths is shown in detail in order to avoid undue repetition, it is
to be understood that similar circuitry 210, 220 and 230 may be used for
generating each of the green, blue and translucency outputs of the cell texture
generator, respectively. Analogous red, green, blue and translucency circuitry
may also be used for providing texture modulation for each parallel pixel
processing path that a real time image generation system may require. Since
translucency data are processed analogously to color data, hereinafter
reference to color may also be taken to apply to translucency unless otherwise
noted.

In order to reduce word lengths representative of color for decreasing memory
size requirements in order to minimize cost and to increase speed of
computation and flexibility of texture rendition, the entire color spectrum is

represented by a set of predetermined quanta, or modulation values, of color.
A general objective of color spectrum quantization is to select a relatively small number of members or color quanta forming a set of color quanta such that a predetermined one of the members of the set may be used to represent each of the colors of the original or source image that is to be displayed, while maintaining a perceived pleasing and accurate rendition of the source image in the image that is ultimately displayed. Attempts to use uniformly distributed color quanta have resulted in significant noticeable differences, such as contouring, between source images and the corresponding displayed images formed from the uniformly distributed quanta of color. Disadvantages of using a set of color quanta, such as a compressed 8-bit code, to represent the entire color spectrum may be eliminated by employing a pyramidal or tapered filtering color quantization scheme to select the members of the set of color quanta in accordance with the present invention. A particular tapered quantization technique that is employed in a presently preferred embodiment of the present invention is similar to the Median Cut method described in "Color Image Quantization For Frame Buffer Display" Paul Heckbert, Computer Graphics, Vol. 16, No. 3 (July 1982).

113g and image data 215g will be described below in turn.

US-PAT-NO: 5138443

DOCUMENT-IDENTIFIER: US 5138443 A

TITLE: Image processing apparatus having means for synthesizing binarized image data

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The input image signal 115 and gradation/resolution switching signal LCHG 141 are input to a texture processing unit 101g. The texture processing unit can be roughly constituted by a texture memory 103g for storing a texture pattern, a memory RD,WR address control unit 104g for controlling the memory 103g, and a calculation circuit 105g for performing modulation processing of input image data on the basis of the stored pattern. Image data processed by the texture processing unit 101g is then input to a zoom, mosaic, taper processing unit 102g. The zoom, mosaic, taper processing unit comprises double buffer memories 105g and 106g, and a processing/control unit 107g, and various processing operations are independently controlled by the CPU 20. The texture processing unit 101g, and the zoom, mosaic, taper processing unit 102 can perform texture processing and mosaic processing of independent areas in accordance with processing enable signals GHi1 (119) and GHi2 (149) sent from the switch circuit N.

FIG. 32 is a circuit diagram for explaining the texture processing unit. A write section of modulation data 218g of the texture memory 113g and a calculation section (texture processing) of data 216g from the texture memory